Commissioner's Office (802) 241-2610
Developmental Services Division (802) 241-2614
Legal Division (802) 241-2602
Fax Number (802) 241-1129

Mental Health Division (802) 241-2604 (Voice/TDD)
Fax Number (802) 241-3052
Vermont State Hospital (802) 241-1000
Fax Number (802) 241-3001

State of Vermont
Agency of Human Services
Department of Developmental & Mental Health Services
103 South Main Street
Weeks Building
Waterbury, Vermont 05671-1601

MEMORANDUM

TO: Vermont Adult Performance Indicator Project Advisory Group

FROM: John Pandiani

DATE: September 19, 1997

RE: Practice Patterns and Hospitalization Rates: A Statewide Program Evaluation

The enclosed article is a formal presentation of the analysis of patterns of community mental health treatment of people with major depression who were assigned to CRT programs in Vermont. You may recognize the research from a brown bag luncheon at our first meeting on January 30, 1997.

I have also enclosed an announcement of an upcoming brown bag luncheon that may be of interest to you.

I look forward to your comments.

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MEMORANDUM

To: Vermont Children's Mental Health Performance Indicator Project

From: John Pandiani

Date: September 12, 1997

A mental health brown bag luncheon presentation

**"Mental Health, SRS, and Special Education Caseload Overlap"**

will be held on October 7 in the "Big Ugly Room" of the Cyprian Learning Center

from 12 noon to 1:00

This presentation is open to the public. Discussion is encouraged. Tell your friends.

If you have any questions, please call me (241-2638) or Pam Mack (241-2639).

# Practice Patterns and Hospitalization Rates: A Statewide Program Evaluation

Steven M. Banks, Ph.D., John A. Pandiani, Ph.D., Lisa M. Gauvin. B.A., M. Elizabeth Reardon, M.P.H., Lucille M. Schacht, M.S., and Andrew P. Zovistoski, M.P.A.

Submitted to Administration and Policy in Mental Health: September 19, 1997

## ABSTRACT

Basic indicators of Community Support Program treatment appropriateness and outcome, and the relationship between the two are reported. The degree to which ten programs conform to practice guidelines for major depression is evaluated. Clients' behavioral health care hospitalization rates subsequent to treatment are measured. Finally, the correlation between hospitalization rates and practice patterns is determined.

Four data sets that describe outpatient and inpatient services over a four-year period, but do not include common person identifiers, were analyzed using Probabilistic Population Estimation. Results indicate there is substantial variation among the community programs in practice patterns and hospitalization rates, and the two are negatively correlated.

## ACKNOWLEDGMENTS

This paper is the result of a collaborative benchmarking project that involved the Vermont Council of Community Mental Health Services and the Vermont Department of Developmental and Mental Health Services. The authors express their appreciation to the members of the Benchmarking Work Group, William McMains, M.D., and J. David Long, Ph.D. for their contribution to the development and conceptualization of this project. This project was supported in part by the Center for Mental Health Services, Mental Health Statistics Improvement Project grant #4 HR1 SM46203-06-3.

This is a revised version papers presented at the 1996 New England Community Mental Healthcare Conference in Portland ME on November 21, and the 1997 NIMH Services Research Conference in Washington D.C. on September 11.

The decade of the 1990s has witnessed a growing concern about the impact of changes in the structure of mental health service delivery systems (Pandiani, Murtaugh, Pierce, 1996), and the growing influence of the continuous quality improvement approach to program management (Walton, 1986). The combination of these concerns has resulted in increasing attention to the development, implementation, and dissemination of mental health program performance measures. The Mental Health Statistics Improvement Project (Ganju, et. al., 1996), representing public sector mental health administrators and regulators, the American Managed Behavioral Healthcare Association (1995), representing the managed care industry, and the National Committee for Quality Assurance (1997), representing private sector purchasers, have all published preliminary sets of performance indicators that focus on or include measures designed for the behavioral health care service sector.

This paper reports two indicators of the performance of a statewide system of publicly funded community support programs for adults with severe and persistent mental illness during a five-year period. The first indicator of program performance is the degree to which clinical practice patterns at community programs conform to professional practice guidelines. This analysis will focus specifically on conformity to American Psychiatric Association (1993) practice guidelines for the treatment of major depression. The second indicator of program performance is the rate at which people with major depression are hospitalized for behavioral health care subsequent to treatment. This analysis will focus specifically on hospitalization for mental health or substance abuse treatment in state, general, veterans', and private psychiatric hospitals during the calendar year subsequent to treatment.

Finally, this paper will examine the relationship between practice patterns and treatment outcomes at the ten community treatment programs over the five-year period covered by the study. This analysis will provide information pertinent to frequently raised questions about the relationship between treatment process and treatment outcomes in settings that are not rigorously controlled in the way of classic clinical trials (Clarkin, et. al., 1996).

## SUBJECTS

The subjects of this paper are the state of Vermont's ten community support programs for adults with severe and persistent mental illnesses. In order to be eligible for a community support program in Vermont, individuals must be over 18 years of age, have a diagnosis indicating a severe and persistent mental illness, have a history of hospitalization or community alternative, need support to live in the community, and have acute or residual symptoms (Vermont Department of Developmental and Mental Health Services, 1996). During 1991 - 1994, these programs varied in size from 81 to 607 people served per year, on average (Table 1). People with a primary diagnosis of major depression averaged between 18% and 36% of the clients of these programs, with per capita penetration rates ranging from 1.0 to 4.1 per 1,000 population. Almost 60% of clients with a primary diagnosis of major depression were less than 50 years of age, and almost two thirds were female.

## METHODS

The methodology used in the evaluation of program performance reported here is noteworthy for two reasons. First, the performance indicators are based exclusively on existing administrative and operational databases. No new data collection was required. Because of the reliance on existing data, this study was substantially more cost effective than a study that would have involved original data collection. In addition, the utilization of existing data allows evaluators to measure past program performance in order to support longitudinal evaluation of the impact of system change on program performance. This study produced program performance indicators for four calendar years, which will be used in the future to evaluate changes in both program and service system level performance.

The second noteworthy aspect of this evaluation is its utilization of Probabilistic Population Estimation to measure treatment outcomes. This statistical methodology allows researchers and program evaluators to determine the amount of overlap between data sets that do not include common person identifiers. In this study, the methodology is used to measure hospitalization rates of community support program clients by determining the proportion of the people represented in anonymous community mental health databases for one year, who are also represented in anonymous inpatient databases for the subsequent year. Because this methodology can produce unduplicated counts of people without unique personal identifiers, it allows researchers to avoid potentially difficult problems regarding personal privacy and the confidentiality of medical records (See Alderman and Kennedy, 1995, for instance).

### Data Sources

The results reported here are based on analysis of four existing databases. One database, the Quarterly Service Report database maintained by the Vermont Mental Health Division, provides basic demographic, clinical, and service data for all clients served by publicly funded community mental health programs since 1991. The data items include client date of birth, gender, and diagnosis, and a record of all services received by each client. The database includes unique person identifiers for each service provider, but the identifiers are not common across providers, and are not shared with any other database.

Three databases provide information on episodes of hospitalization for behavioral health care. A Hospital Discharge Data Set maintained by the Vermont Department of Health includes records of all episodes of inpatient care in general hospitals in Vermont and New Hampshire, and in the Veterans Administration Hospital in White River Junction, Vermont since 1985. For this study, a database extract that describes all episodes of behavioral health care (mental health and substance abuse) during 1992 through 1995 was obtained from the Department of Health. This data set includes patient date of birth, gender, and diagnosis, and the dates of admission and discharge for each episode of hospitalization. The data set contains one record for every episode of hospitalization and includes no unique person identifier. Data from two other inpatient facilities were integrated with the behavioral health care extract from the Hospital Discharge Data Set for the purpose of evaluating the outcome of community mental health treatment. Data describing episodes of care during 1992 through 1995 at The Brattleboro Retreat, Vermont's only private

psychiatric hospital, were obtained from that facility. Data describing episodes of care during 1992 through 1995 at the Vermont State Hospital, Vermont's only public psychiatric hospital, were obtained from that facility. Data items include patient date of birth, gender, and diagnosis, and the dates of admission and discharge for each episode of hospitalization. These data sets include no common person identifiers.

All of these data sets include information that originally resided in more detailed operational and administrative databases that support billing and other financial functions. Because of demands for fiscal accountability by payors and regulators, these databases are subjected to both internal and external audits on a routine basis. We believe the policies and procedures governing these administrative databases, combined with the safeguards of routine auditing functions assure that the data provide a valid and reliable record of the activities of these hospitals and community programs.

**Practice Patterns**

The American Psychiatric Association's Practice Guidelines for Major Depression recommend, with substantial clinical confidence, that " Most patients are best treated with antidepressant medication coupled with psychotherapeutic management or psychotherapy" (APA, 1993). Conformity to this practice guideline was measured by searching the service records for each client with a primary diagnosis of major depression who received services from a community support program during each calendar year from 1991 through 1994. The results of this search were coded to indicate whether or not each client had received both therapy and medication management during the year. Our measure of program performance with regard to conformity to practice guidelines is the proportion of clients with a primary diagnosis of major depression who received both therapy and medication management during each of the four years being examined.

**Hospitalization Rates**

Hospitalization rates, operationalized in a number of different ways, are among the most widely recommended performance indicators for behavioral health programs. Almost 90% of respondents to the Institute for Behavioral Healthcare survey of behavioral health facilities, behavioral group practices, and managed care organizations indicated that hospitalization rates would be a useful performance indicator (Kramer, et. al., 1996). The HEDIS mental health care performance measures for health plans include number of hospitalizations and length of stay, percent of members hospitalized, and readmission rates (National Committee for Quality Assurance, 1997). In the MHSIP Consumer-Oriented Mental Health Report Card, avoidance of hospital readmission is included among program performance measures in the outcome domain because, "avoiding the recurrence of acute illness... is an important benchmark of effective mental health treatment" (Ganju, et. al., 1996).

Our measure of hospitalization is the rate of inpatient behavioral health care during the year subsequent to the year in which community support services were received. More specifically, the measure of treatment outcome used in this study is the behavioral health care hospitalization rate for people with major depression who were served by each community support

program during each year of the study period. Behavioral health care hospitalizations include all episodes listed under the Major Diagnostic Categories for mental health or substance abuse (MDCs 19 and 20). Because the various data sets used in this study do not share a common person identifier, the proportion of community support clients who were subsequently hospitalized is determined using Probabilistic Population Estimation.

**Probabilistic Population Estimation**

Probabilistic Population Estimation is a statistical procedure derived from a solution to the classic mathematical "coupon collector problem" (Feller, 1957). This procedure provides a probabilistic estimate of the number of people who are represented in a data set that does not contain a unique person identifier. This estimate is based on information on the distribution of dates of birth in the general population, and the distribution of dates of birth that is observed in the data set. Because this procedure uses the number of dates of birth represented in a data set, not the number of records in the data set, the data set may include multiple records for individual people (e.g., event or episode records). (See Pandiani, Banks, and Gauvin, 1997; and Banks and Pandiani, in press, for a more detailed discussion.)

In order to derive the estimate of the number of people represented in a data set that does not contain a unique client identifier, the complete data set was broken into smaller data subsets in which all records have the same gender and year of birth (e.g., all records for females born in 1965). The number of distinct birthdays that occurred in each data subset was counted. The number of people necessary to produce the observed number of birthdays was calculated using the following formula:

$$P_j(l_j) = \sum_{i=1}^{l_j} \frac{365}{365 - i}$$

where "$P_j$" is the population estimate for subset "j", and "i" is the number of days observed in the year. Confidence intervals for the estimate may be calculated using a similar procedure. Estimates of the total number of people represented in the complete data set and the confidence intervals for this estimate were obtained by combining the results for every year of birth and gender cohort in the original data set.

In order to probabilistically determine the number of people shared by the community support and the inpatient behavioral health care data sets that do not include a common person identifier, the sizes of three populations were determined, and the results are compared. First, the number of people represented in each community support program data set was determined. In the current study, the number of people in each of the community support programs is known because each includes a unique person identifier. As part of a standard diagnostic procedure, actual client counts (based on the unique person identifiers) were compared to probabilistically estimated client counts. The 95% confidence intervals of the probabilistic estimates included the true value in every case. In 34 of the 40 comparisons, the 95% confidence intervals were within 2% of the point estimate, and the 95% confidence intervals never exceeded 3% of the point estimate.

The number of people represented in the data set that describes episodes of hospitalization for behavioral health care was then determined. Because the hospital data set does not include a unique person identifier, this number was probabilistically determined.

The third data set was formed by combining each of the community support data sets with the statewide inpatient data set for each of the years of the study. The number of people represented in the combined data set was then determined. In the current study, the number of people represented in the combined (concatenated) data sets was estimated using probabilistic population determination because no unique person identifier is available.

The number of people who are shared by the community and the inpatient data sets is the difference between the sum of the numbers of people represented in the two original data sets and the number of people represented in the combined data set. This result occurs because the sum of the number of people represented in the two original data sets will include a double count of every person who is represented in both data sets. The number of people represented in the combined data set does not include this duplication. The difference between these two numbers is the size of the duplication between the two original data sets, the size of the caseload overlap.

When no one is represented in both data sets, the number of people represented in the combined data set is equal to the sum of the numbers of people represented in each of the original data set, the data sets are mutually exclusive. When every person represented in the smaller of the original data sets is also represented in the larger of the two original data sets, the number of people represented in the combined data set is equal to the number of people represented in the larger of the two original data sets.

In terms of mathematical set theory (Whitehead and Russell, 1927), the intersection of two sets ($A \cap B$) is the difference between the sum of the sizes of the two sets ( $A + B$) and the union of the two sets ($A \cup B$):

$$(A \cap B) = A + B - (A \cup B)$$

Our measure of community support treatment outcome was derived for each of the ten community programs during each of four years by measuring the overlap between the community support caseload with major depression for each year and the statewide inpatient behavioral health care caseload for each subsequent year, and expressing the result as a percentage of the community support caseload.

**Practice Patterns and Treatment Outcomes**

The final question to be addressed in this paper regards the relationship between each community support program's rate of conformity to practice guidelines for the treatment of major depression, and each program's rate of hospitalization of people with major depression subsequent to treatment. This relationship is examined by measuring the correlation between rates of conformity to practice guidelines and rates of subsequent hospitalization for ten community support programs in each of four years (n=40).

## RESULTS

The study analyzed data on community mental health practice patterns and subsequent behavioral health care hospitalization rates in a statewide system of care over a four-year period. The results indicate that there are significant differences among programs' practice patterns and hospitalization rates, and that hospitalization rates of community support programs are related to their conformity to professional practice guidelines.

To what degree do practice patterns in community support programs conform to American Psychiatric Association practice guidelines for the treatment of major depression? The statewide average rate of conformity to practice guidelines for the treatment of major depression at community support programs in Vermont during 1991 through 1994 was 59%. Average conformity at individual programs varied from 35% to 82% at the ten community support programs (Table 1). There was no significant change in the rates of conformity during this four year period ($p=.89$). There was, however, significant variation in conformity to these practice guidelines among the ten programs ($p<.001$).

How much do hospitalization rates for people with major depression vary among community support programs? Statewide, the behavioral health care hospitalization rate for people with major depression at Vermont's ten community support programs averaged 14% during the period of this study. Average hospitalization rates for individual programs ranged from 9% to 18% at the ten community support programs. There was no significant change in hospitalization rates during this four year period ($p=.96$). There was, however, significant variation in hospitalization rates among the ten programs ($p<.001$).

Are hospitalization rates related to rates of conformity to practice guidelines? Hospitalization rates are significantly related to rates of conformity to practice guidelines at community support programs in Vermont during 1991-1994 ($r=-.49$, $p<.001$). Community support programs with higher rates of conformity to American Psychiatric Association practice guidelines for the treatment of major depression had significantly lower rates of hospitalization subsequent to treatment than community support programs with lower rates of conformity to practice guidelines (Figure 1).

## DISCUSSION

The results reported above can be of use to at least three distinct schools of mental health service systems research: the evaluation of program performance, the establishment of benchmarks for continuous quality improvement, and research on treatment effectiveness in non-research settings. Because this study used existing data resources combined with probabilistic statistical analysis to measure program level performance, the project was more efficient than more traditional approaches that involve original data collection, and provided greater protection of personal privacy than is possible when data on individual clients and patients are combined and analyzed.

Program performance monitoring and clinical practice benchmarking are distinguished

primarily by the organizational affiliation and the intent of the user of the research results. Program performance monitoring tends to be the concern of purchasers of services, consumers, and regulators. The intent of monitoring program performance is frequently related to purchasing, funding, or licensing decisions. Continuous quality improvement tends to be the concern of programs and people who provide direct services. Continuous quality improvement uses research results as a tool to help change practice patterns and outcomes to more closely approximate the ideals of the practitioners, purchasers, or communities.

The results indicate that both conformity to practice patterns and hospitalization rates are enduring attributes of community support programs. There was no statistically significant change in the performance of individual programs over the four years covered by this study. The results also indicate that there are statistically significant differences among the individual programs on their performance in both areas. Both of these statistical properties make these indicators ideal candidates for continued monitoring for both performance evaluation and continuous quality improvement. They allow consumers, service providers, purchasers, and regulators to compare the performance of individual community support programs to the performance of other programs, to the performance of the same programs in different time periods, and to their own ideas about ideal performance.

The results reported above also indicate that rates of conformity to professional practice guidelines has a significant impact on rates of hospitalization subsequent to treatment. This finding provides an example of the kind of research on treatment effectiveness that is being increasingly advocated in the professional literature:

> "Effectiveness studies determine the external validity or generalizability of treatments under more ordinary, less pristine conditions. This may mean that the treatment setting is a community clinic, the providers are not specially selected but those normally employed in community clinics, and the patients, who still meet diagnostic criteria, might have co-morbid medical or mental disorders. The goal of effectiveness research is to provide information about outcomes of interventions when they are applied to most patients by practicing clinicians in non-research settings." (Clarkin, Pilkonis, and Magruder, 1996)

Future work in this area should be designed to support program evaluation, continuous quality improvement, and research on treatment effectiveness in real world settings. Knowledge of practice patterns and hospitalization rates in other states, and for other types of provider organizations will enhance the utility of these findings for program evaluation by payors, regulators, and consumers. Continued monitoring of practice patterns and hospitalization rates over time will support continuous quality improvement efforts by service providers. In both cases, increased availability of standardized, objective measures of program performance such as those presented here will help to advance the utility of service systems research for program evaluation and continuous quality improvement.

From a research perspective, future work in this area should consider the influence of other service system attributes on the relationship between practice patterns and hospitalization rates that

was uncovered here. Specifically, analysis should be designed to statistically control community effects and overall program effects on the relationship between practice patterns and hospitalization rates. Is the relationship between hospitalization rates and practice patterns that was uncovered here a function of the overall quality of care provided by treatment programs rather than the particular practice pattern evaluated here? Is the observed relationship between hospitalization rates and practice patterns a function of characteristics of the larger community in which they were observed rather than the particular practice pattern evaluated here?

Two aspects of the methodology used in this research can be particularly valuable in future service system research for program evaluation, benchmarking, and treatment effectiveness studies. First, the analysis reported above relied solely on existing administrative and operational databases. Very powerful measures of program performance in the areas of practice patterns and treatment outcomes were produced with no new data collection. The use of existing data resources substantially reduces the expense associated with service systems research. Because administrative data sets frequently include data that describes past service system activities it is possible to efficiently produce indicators of program performance for a number of recent years. Past program performance can then be used to help evaluate current program performance. When service system change is implemented it is possible to retrospectively monitor the performance of the old system, and then use the same measures to monitor changes in system performance as they occur. Sophisticated "repeated measures" research designs can be used to continually monitor program performance with none of the expense of original data collection. The increasing availability of operational and administrative data sets, even in small human service organizations, suggests that this approach to service systems research is likely to grow in the future.

The probabilistic methodology used in this research adds to the utility of existing data resources by providing a way to reliably measure program and service system performance when data sets do not include common person identifiers. Probabilistic population estimation has the added advantage of protecting personal privacy and the confidentiality of medical records because it does not rely on unique person identifiers.

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# Table 1
## Average Annual Conformity to Practice Guidelines and Hospitalization Rates for People with Major Depression at Ten Community Support Programs 1991 - 1994

| | People Served | | | | Performance Indicators | |
|---|---|---|---|---|---|---|
| | Total | With Major Depression | | | Conformity to Practice Guidelines | Hospitalization Rates |
| | Number | Number | Percent of Total | Per 1,000 Population | | |
| Clinic 1 | 126 | 31 | 24% | 1.2 | 70% | 10% |
| Clinic 2 | 189 | 56 | 30% | 1.7 | 86% | 8% |
| Clinic 3 | 571 | 153 | 27% | 1.5 | 31% | 19% |
| Clinic 4 | 149 | 35 | 24% | 2.3 | 47% | 11% |
| Clinic 5 | 389 | 71 | 18% | 1.0 | 61% | 18% |
| Clinic 6 | 485 | 174 | 36% | 4.1 | 53% | 17% |
| Clinic 7 | 81 | 19 | 26% | 1.0 | 67% | 17% |
| Clinic 8 | 283 | 94 | 33% | 2.0 | 82% | 11% |
| Clinic 9 | 210 | 50 | 23% | 1.8 | 67% | 13% |
| Clinic 10 | 607 | 147 | 24% | 3.5 | 47% | 19% |

Figure 1

Practice Patterns and Hospitalization Rates
For Ten Community Support Programs
1991 - 1994